

# Teaching by example? Integrating ICT in Teacher Education

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**Abstract:** *Teachers are strongly encouraged to integrate or, preferably, make integral, ICT in their teaching. If, as is often the case, teachers' first impulse is to teach as they were taught, then the most effective way to prepare them to teach with ICT may be to ensure that ICT is integral to teacher preparation programs. This was the basis on which in 2003 a redesign of the Bachelor of Education program removed specific ICT courses in favour of integrating ICT throughout all courses. This paper reviews some key literature about ICT in teacher education and reports on data about integration of ICT in the first (2004) and most recent (2007) years of the new program. The success or not of the redesign will be considered together with lessons for the next redesign being undertaken in 2008 for implementation commencing in 2009.*

## INTRODUCTION

There is increasing pressure for teacher education programs to graduate teachers who are confident and competent in using ICTs for their personal and professional lives. At a program level this requires a move beyond random acts of innovation in which early adopters continue to explore opportunities for ICT integration to extend and enhance learning. Teacher educators can no longer view ICT integration as an option or something new and not relevant to their courses. To adequately prepare teachers for work in the classrooms of tomorrow, teacher preparation programs need to develop programs that infuse ICTs into the entire program using authentic and pedagogically appropriate approaches. That is, 'students should learn about, learn with, and learn to incorporate technology into their own teaching' (SITE, 2002).

Jacobsen, Clifford, and Friesen (2002) comment that '[i]t is simply not good enough to teach the next generation of teachers in ways we were taught because they will live and teach children in a different age' (p. 367). With few personal and professional experiences to draw from it is no wonder that teacher educators are struggling to create rich learning experiences which model effective learning experiences in technology enhanced classrooms. Jacobsen et al., (2002) comment that teaching and learning with ICTs can be overwhelming and intimidate pre-service teachers, in-service teachers and university faculty. In addition Ertmer, Gopalakrishnan and Ross (2001) reflect that 'not only do the tools themselves continue to change at a rapid pace, but so does the prevailing wisdom on how teachers should use these technologies in schools' (para. 1).

The effectiveness of ICT integration is impacted by the teachers' motivation to integrate, personal knowledge and experience with ICTs, confidence in ICT use, access to ICT resources and training, teacher preparedness and technical and pedagogical support (Cabanatan, 2002). Ertmer, (2005) argues that '[a]lthough the conditions for successful technology integration finally appear to be in place, including ready access to technology, increased training for teachers, and a favourable policy environment, high-level technology use is still surprisingly low' (p. 25).

Against this background of financial outlay and disappointment, Kirschner and Davis (2003) argue that enabling teachers to make effective use of ICT as a tool for deep learning should be 'top priorities for both pre-service and in-service programmes' (p. 125). Infusing ICT competencies in teacher education is not a new concept. The Society for Information Technology and Teacher Education

(SITE, 2002) has previously recommended three principles for the improvement of ICT and teacher education:

1. Technology should be infused into the entire teacher education program;
2. Technology should be introduced in context; and
3. Students should experience innovative technology-supported learning environments in their teacher education program.

The *Raising the Standards* report (Department of Education, Science and Training, 2002), noted that there were no common ICT standards for teacher educators in Australia. This report suggested that at the pre-service teachers level ICT use would be 'as a tool for learning to enhance students' abilities to deal with the existing curriculum and existing learning processes' (p. 33). Also at the national level in Australia, the Ministerial Council for Employment, Education, Training and Youth Affairs (MCEETYA, 2005) document, *Learning in an Online World*, focuses on the development of '[p]edagogies that integrate information and communication technologies [because they] can engage students in ways not previously possible, enhance achievement, create new learning possibilities and extend interaction with local and global communities' (p. 2).

At the state level, in Queensland, teacher education programs must respond to a set of professional standards. The scope of the key professional standard is that 'Teachers design and deliver learning experiences for individuals and groups, that employ a range of developmentally appropriate and flexible teaching, learning and assessment strategies and resources in information and communication technology enriched environments' (QCT, p. 5). In addition there are practice, knowledge, value statements related to ICT in 8 of the other 9 standards. (e.g., 'provide opportunities for students to purposefully use a range of communication tools and participate through ICT in local, national or global communities' (p. 12).

The presumed effect of these standards on pre-service teachers reflects Pearson's (2003) statement that 'beginning teachers should be better placed to integrate ICT into their own teaching and bring about pedagogical changes in schools that have been anticipated for so long' (p. 54). In addition '[e]xperienced teachers are looking towards new graduates for competency and leadership in the area of technology integration' (Jacobsen et al, 2002, p. 384), due to limited access, or will, to further develop their own ICT skills and knowledge.

In rising to these challenges teacher education programs have attempted to providing modelling and practice to further learning about ICTs, learning with ICTs and learning how to learn with ICTs. Ertmer, (2003) suggests that, to support and sustain meaningful changes in teaching and learning, teacher education programs should move beyond skills development and implement the following three components: building collaborative structures, modelling effective technology use, and reflecting on current practices and beliefs.

This paper reports on aspects of one teacher education program's journey to integrate ICTs in meaningful ways and to respond to the above principles and standards. It describes some of the history of ICT in the program and presents data about the use of ICT in courses. In addition it will briefly explore future options as the faculty begins to conceptualise a revised teacher education program.

## **BACKGROUND**

The Bachelor of Education (BEd) program at the University of Southern Queensland (USQ) has implemented a variety of approaches at different times to prepare pre-service teachers for the application of ICT in their classrooms. Commencing in the 1980s, these approaches have ranged from skills development and awareness raising to ICT skills based courses and single courses focused on the pedagogical aspects of ICT integration. In addition, various electives that extended ICT skills and curriculum application have been available with varying levels of uptake.

In the 2003 re-accreditation of the BEd, those responsible for the design of the program responded to a perceived increase in the ICT skills of students by removing the previously required ICT skills course. They were also aware of the widespread view that ICT should be integrated into teaching rather than treated separately and recognised the value of pedagogical models in teacher education as a response to the tendency of teachers to teach as they were taught' (Zachariades & Roberts, 1995). Hence the program introduced in 2004 adopted a fully integrated approach to ICT as the means of preparing the pre-service teachers to design and implement learning in technology enriched environments.

In late 2007 the Faculty began work on another re-accreditation of the BEd to be completed during 2008 with the revised program to be offered from 2009. The impetus for the re-accreditation came from changes in registration requirements and the desire to make Faculty operations more efficient by reducing the total number of courses required to service students preparing for different levels of education. Although the arrangements for ICT in the program were not a factor in the decision to re-accredit, changes in expectations for ICT preparation (DETA, 2008b; QCT, 2007) provided powerful prompts for a review of ICT provision in the current program as a basis for redesign.

## **METHOD**

This study originated against that background and sought to extend the work of a previous study (Redmond & Albion, 2005) that gathered data about current and anticipated integration of ICT in BEd courses and the related ICT capabilities of faculty members. For that study, ICT standards from relevant sources were used as the basis for development of two questionnaires covering 34 aspects of relevant knowledge and skills. The items covered software capabilities (word processing, spreadsheets, etc.), systems and communication capabilities (file management, email, etc.), hardware (digital camera, scanner, etc.), and pedagogy (planning for ICT integration, resource selection, management issues, etc.) together with some contextual information such as courses taught.

The first questionnaire sought information about ICT use in courses, using pairs of questions in which the first asked respondents indicate the extent to which students in a course were required to demonstrate some aspect of ICT use. Alternatives were 'not required', 'required' and 'assessed'. The second question was answered only when 'required' or 'assessed' was selected for the first and offered two alternatives, 'assumed on entry' and 'taught in the course'. The second questionnaire sought information about the ICT capabilities and related professional learning priorities of faculty members teaching BEd courses. For each of the 34 identified aspects of ICT use respondents were asked to rate the extent to which their present knowledge and skills would allow them to model the use in class. Responses were on a 5 point scale from 1 = 'not at all' to 5 = 'to a high standard'. A second set of items sought an indication of the level of importance attached to learning about each of the 34 aspects of ICT use using a scale from 1 = 'very little importance' to 5 = 'very high importance'.

The instruments were administered online using an open source package, PHP Surveyor, which facilitated the email distribution of invitations and reminders and also collated data in a form that could be conveniently transferred to SPSS for analysis. Most of the items were constructed as sets of check boxes with a few short answer items being used for details of courses and open comments.

For the present study, which sought to investigate the implementation of ICT integration in the program, only the first instrument was administered. Email invitations were sent to examiners of 126 undergraduate courses listed in the faculty catalogue. A small proportion of the courses may have been inactive and several staff members would have received multiple invitations, one for each course managed. Sixty-three usable responses were received and downloaded for analysis, representing a response rate of approximately 50%. Considering that the invitations included some inactive courses and duplicates for individuals, the responses represented a reasonably broad coverage of the program.

## **RESULTS AND DISCUSSION**

Table 1 presents the data for selected items indicating how ICT integration was being implemented in 2007. For comparison, data reported in the previous study are included. The columns labelled 'Implemented, 2004' represent data referring to courses in the previous program as they were being implemented in 2004. Those labelled 'Anticipated, 2004' represent what was being planned for implementation in the new program.

The relative numbers of courses for which responses were obtained in 2004 and 2007 reflect the transition from the previous program to the new. In 2004 teaching was spread across the two programs but by 2007 courses from the previous program had all but disappeared. The total number of courses being offered in 2007 was similar to that in 2004.

	Old program (N = 29) (Implemented, 2004)					New program (N = 27) (Anticipated, 2004)					New program (N = 63) (Implemented, 2007)				
	Not required	Required	Assessed	Assumed	Taught	Not required	Required	Assessed	Assumed	Taught	Not required	Required	Assessed	Assumed	Taught
Word processing	6	16	7	20	3	3	18	6	21	3	15	40	8	44	4
Spreadsheet	27	-	2	-	2	25	-	2	-	2	60	-	3	-	3
Database	21	8	-	5	3	21	6	-	3	3	50	11	2	8	5
Presentation software	20	6	3	7	2	20	5	2	6	1	40	16	7	15	8
Video editing	29	-	-	-	-	27	-	-	-	-	58	3	2	3	2
Image editing	27	2	-	2	-	25	2	-	2	-	58	3	2	1	4
Web publishing	27	1	1	1	1	24	1	2	2	1	59	1	3	1	3
Internet searching	7	20	2	12	10	5	19	3	12	10	8	51	4	33	22
Library databases	7	19	3	15	7	3	19	5	16	8	16	43	4	27	20
Digital camera	27	2	-	2	-	24	3	-	2	1	50	10	3	7	6
Scanner	29	-	-	-	-	26	1	-	1	-	59	4	-	3	1
DV camera	29	-	-	-	-	26	1	-	1	-	56	5	2	4	3
Planning for ICT integration	20	6	3	1	8	20	5	2	-	7	39	14	10	1	23
Creating ICT activities	22	4	3	1	6	20	6	1	-	7	49	8	6	1	13

**Table 1: Numbers of courses in which aspects of ICT use are demonstrated and or developed**

In both sets of data, the skills most commonly required and assessed were Internet searching, Library databases and word processing. The proportions of courses requiring, but not assessing, these in 2007 were 81%, 68% and 63% respectively, compared to practice and intentions of 70%, 68% and 61% in 2004. The corresponding proportions of courses assessing, or intending to assess, these skills in 2007 were 6%, 6% and 13% and 9%, 14% and 23% in 2004. This suggests that most courses may be continuing with traditional practices of literature-based research for production of written texts, most probably essays of some form for assessment. Given that the focus in the courses is more likely on relevant content than on the development of ICT skills, the low proportions assessing those skills directly are probably appropriate. Word processing more directly assessed in more courses than the search skills. This is most likely because the product is directly observable in printed submissions whereas staff members are less likely to be able to directly observe search skills.

About 40% of courses reported teaching Internet and Library database search skills in 2007, compared to just 8% that taught word processing. The remaining courses assumed that the requisite skills were learned elsewhere. Depending upon the actual skills required and where a course falls in the program sequence that may be a reasonable assumption, but the apparent mismatch raises questions about the match between course objectives and assessment if substantial effort is devoted to teaching material that is not assessed.

Again, as in 2004, there was a second tier of capabilities required by a moderate proportion of courses. In 2007 these comprised presentation software (25%), planning for ICT integration (22%), database (17%), digital camera (16%), and creating ICT activities (13%). The corresponding list reflecting practice and intentions in 2004 comprised database (25%), presentation software (20%), planning for ICT integration (20%), and creating ICT activities (18%). As for the first tier capabilities, the proportions of courses assessing these capabilities were lower than those requiring the capabilities - presentation software (11%), planning for ICT integration (16%), database (3%), digital camera (5%), and creating ICT activities (10%). Knowledge of the program suggests that it is unlikely that database software use is substantial and the inclusion of database in this list probably results from an assumption by respondents that it represented Library database use.

Although the relative proportions have changed, the list is consistent from 2004 to 2007 except for the inclusion of the digital camera in 2007 with a shift from an 11% anticipated requirement in 2004 to 21% required or assessed in 2007. In 2004, 2 courses reported requiring digital camera capability and 3 courses anticipated a future need. In 2007, 10 courses reported requiring the capability with a further 3 assessing that capability. This may represent a move towards inclusion of a wider range of media, beyond simple text, in the new program courses. Such a trend may be reflected in smaller, but still increased, proportions of courses reporting some requirement for scanner or video camera capabilities and related editing software.

Where these second tier capabilities are required in courses, the data suggest that the courses are more likely to address the development of the capability than was the case for word processing. The proportions teaching the necessary skills were presentation software (35%), planning for ICT integration (96%), database (38%), digital camera (46%), and creating ICT activities (93%). This suggests a broad acceptance among the relevant staff members that they cannot assume that the necessary skills have been learned elsewhere and that there is a need for courses to address the skills in the context of their application.

The remaining capabilities, spreadsheet, video editing, image editing, web publishing, scanner and DV camera, are all addressed in at least one course and are taught in one or more of those courses. That is more than was revealed in the 2004 data but may still not be sufficient to ensure that graduates are familiar with both the relevant capabilities and their educational potential. Any revised program will need to include greater exposure to the use of ICT to support learning and teaching.

## **CONCLUSION**

Compared to the previous program (2000 accreditation), and even to what was anticipated for the current program when it commenced in 2004, the current implementation of the teacher preparation program at USQ appears to require more of students in respect of ICT use and to provide more opportunities for developing relevant capabilities. Although relatively few courses teach or assess ICT capabilities directly, the assessment instruments in many cases require students to produce artefacts using ICT, thus incorporating ICT indirectly in the assessment. By implication, these inclusions in assessment encourage students to practise existing skills and, where necessary, develop additional skills. Where the relevant skills are not taught in the course, any skills development will most likely be by informal means such as working with peers or by trial and error with the software and whatever help may be available. In this respect ICT appears to be becoming more integral to learning and teaching within the program in the sense that it is more widely understood to be a regular component of practice. An optimist might interpret the assessment of artefacts produced with ICT and absence of

direct teaching and assessment of ICT as evidence of ICT use becoming transparent and integral and of lecturers providing appropriate pedagogical models for graduates to emulate.

However, closer inspection of the data suggests that increase may be largely due to the same people doing more with ICT rather than substantially more widespread adoption. There is also anecdotal evidence that some staff may assume that students generally are more skilled than is the reality and may set assessment tasks that are beyond their own ICT skill levels. In such cases students are left to their own devices to develop any necessary skills and this has occasionally led to increased pressure on limited technical support services and other faculty members thought to have the relevant skills. These are probably inevitable consequences of raising expectations for ICT integration in courses without providing for the professional development required by staff to extend ICT skills and to design activities that make appropriate use of ICT.

Although the apparent changes represented in the data of Table 1 represent progress towards more widespread integration of ICT in the program, it is doubtful that the changes are quantitatively or qualitatively sufficient to ensure that all new graduates are adequately prepared for professional practice. With relatively few courses addressing some ICT capabilities, it is possible that some students may miss certain capabilities entirely or, if they are exposed in the courses, depending upon their prior and subsequent experience, receive less opportunity than they require for development of the relevant capabilities. To the extent that these ICT capabilities are required by graduates to meet employer requirements (DETA, 2008a; QCT, 2007) it is imperative that any revision of the BED program should the issue.

It seems unlikely that there is a single, simple reason for the limited success of an integration-only strategy for ICT provision in the BED program. Possible contributing factors included limited professional development for staff in both ICT skills and related pedagogy, limited access to appropriate equipment, and limited scope in an already crowded curriculum for skills development where that was required. If the revised program to be offered from 2009 is to be more effective at preparing graduates for increasing expectations in relation to ICT (DETA, 2008a), then these issues will need to be addressed in the program design and implementation. The revised program will include a required course that addresses the pedagogical use of ICT with support provided for skills development where required by students. This approach is considered preferable to including a required skills course because of the wide variation in ICT skills of students entering the program. The ICT pedagogy course is to be placed early in the second half of the program so that students will already have some knowledge of curriculum and pedagogy and experience of working in educational settings.

Shulman (1986) identified *pedagogical content knowledge* (PCK) as the knowledge required by teachers to transform content so that it is accessible to learners. The necessary basis for that transformation is knowledge of both content and pedagogy, which students will be developing by the time they enrol in the ICT pedagogy course. More recently the concept of PCK has been extended (Mishra & Koehler, 2006) to consider the intersection with knowledge of technology (ICT) in *technological pedagogical content knowledge* (TPCK), which is the knowledge that enables teachers to solve the problems of practice by planning appropriate combinations of pedagogy and ICT to support learners working with content in a specific context.

In order for the proposed ICT pedagogy course to address TPCK appropriately, in addition to their developing knowledge of curriculum and pedagogy, students will need a repertoire of relevant ICT capabilities. Some, perhaps many, students will have acquired those capabilities prior to enrolling in the program or may develop them in other contexts. However, for the program to be successful in developing TPCK for all students, it will be necessary to ensure that all students have necessary background in technology, content and pedagogy. In the absence of a specific course to develop ICT capabilities, there will need to be a coherent approach to ensuring that students have essential capabilities when they enter the ICT pedagogy course. The current plan is to ensure that courses

offered in the first years of the program include learning and assessment activities that tap a variety of ICT skills and provide support mechanisms for students who need to extend their ICT skills.

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